ELECTRIC HOME PASTEURIZERS

U. S. DEPARTMENT OF AGRICULTURE

RURAL ELECTRIFICATION ADMINISTRATION

ELECTRIC HOME PASTEURIZERS FOR MILK AND CREAM

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Many diseases of humans are milk-borne. Such disease outbreaks reported by state and local health authorities as having occurred in the United States include typhoid fever, scarlet fever, septic sore throat, food poisoning, paratyphoid fever, undulant fever, dysentery, diphtheria, Q-fever, and others. According to health authorities, proper pasteurization of milk can and does prevent their transmission and all milk-borne disease is preventable. Further, no raw milk can be guaranteed as safe.

Based upon Public Health Reports for the 10-year period, 1932 to 1941, the estimated average annual economic loss from milk-borne diseases among humans in the United States amounts to more than $2,800,000. Of these, undulant fever ranks first with about $2,150,000; typhoid fever second with $400,000; and scarlet fever and septic sore throat third with $200,000. The number of undulant fever cases and deaths reported in the United States by years since 1932 follows:

Undulant Fever

Year	Cases	Deaths	Year	Cases	Deaths
1932	1,502	62	1941	3,484	71
1933	1,788	72	1942	3,228	76
1934	2,017	65	1943	3,734	77
1935	2,008	98	1944	4,436	80
1936	2,095	107	1945	5,049	101
1937	2,675	82	1946	5,887	69
1938	4,379	116	1947	6,147	58
1939	3,501	121	1948	4,886	55
1940	3,310	116	1949	4,124	*

*Not yet available

Public health authorities are of the opinion that the previous figures as to the number of cases and deaths due to undulant fever constitute only a small percentage of the actual. According to them reporting facilities in many areas are inadequate and because of the comparative rarity of the disease and consequent deficiency of knowledge and the difficulty of diagnosis it is not always recognized. Most of the reports received come from cities and metropolitan areas.

The figures presented on undulant fever also include those individuals who contracted it because they handled diseased meat. However, health authorities emphasize that the transmission of the disease to humans caused by consumption of infected raw milk can be avoided through proper pasteurization. The Rural Electrification Administration has stressed for more than six years the development of electric milk pasteurization equipment suited for use in the farm home and by the small milk retailer. Definite progress has been made not only in its development but also in redesigning it to improve its operating characteristics to insure positive pasteurization. To the researchers of several state agricultural colleges and the U. S. Public Health Service who tested these units is due a good share of the credit for these improvements. Manufacturers, inventors, distributors and others are to be commended for the part they played in the production and marketing of high quality electric milk pasteurizers for the home. Several are now on the market and there may be others in the future.

Before describing specific units, it might be well to review briefly the history of pasteurization and define the process. As commonly thought, the process of milk pasteurization did not originate with Louis Pasteur. He, however, did introduce the method and used it for heating beer and wine so as to prevent souring. In 1873, Jacobi of New York City recommended that milk for infant feeding be boiled in the bottles. As far as is known, he was the first to advocate the heating of cows' milk. Twenty years later, 1893, Nathan Straus, New York City, was the first to sell sterilized milk. In short order, many others followed suit. Continuous-flow milk heating equipment was developed between 1890-1905 using temperatures from 158° to 165° F. This was not too satisfactory as controls were inaccurate and holding times indefinite. In 1906, Rosenau found that he could destroy the most heat-resistant, milk-borne pathogen at 140° F. in 20 minutes. Because of his work and the corroboration of it by other investigators, low-temperature pasteurization was generally accepted by health authorities. Great improvements were made in the commercial equipment because of the development of adequate temperature controls. These improvements led to the acceptance of high-temperature, short-time pasteurization by health authorities. These two methods are defined by the Milk Ordinance and Code as follows: "The term 'pasteurization, pasteurized' and similar terms shall be taken to refer to the process

of heating every particle of milk or milk products to at least 143° F., and holding at such temperature for at least 30 minutes, or to at least 160° F., and holding at such temperature for at lease 15 seconds, in approved and properly operated equipment; provided, that nothing contained in this definition shall be construed as disbarring any other process which has been demonstrated to be equally efficient, and is approved by the State health authority."

What effect does the process of pasteurizing milk have on its nutritive value? Do children who drink raw milk thrive better than children who drink pasteurized or other heated milk? U. S. Public Health Service in a study of over 3,700 white children of ten months to six years of age who were fed the average supplementary diet in addition to milk concluded that children who are fed pasteurized milk or other heated milk thrive as well as children who are fed raw milk and contract certain communicable diseases less frequently.

Pasteurized milk is available in most of the larger communities. The United States Public Health Service estimates that 85 percent of all market fluid milk is pasteurized. This figure does not include the many milk producers who still use raw milk. For these dairymen and others using raw milk, pasteurization equipment, which is low in initial cost, yet effective, must be provided. What has been done to meet this need? Let us take a look.

Three electrically heated, thermostatically controlled, automatically operated home milk pasteurizers are available. Their main differences are: in one the milk container is heated by a water bath; in another, the milk container is heated directly; and in the third, milk-in-bottles is heated by a water bath.

Batch Pasteurizers

Two batch pasteurizers, in which the milk is heated by a water bath, are manufactured by SAFGARD Division, Grand Sheet Metal Products Company, 2501-2559 West 24th Street, Chicago 8, Illinois. Both have a capacity of two gallons but as little as two quarts of milk can be pasteurized in either. Both are approved by Underwriters' Laboratories, Inc.

One of these known as model P-1000 is marketed by Montgomery Ward, Chicago, Illinois. This pasteurizer stands approximately 21 inches high and has an outside diameter of about 12 inches. It consists of an outer rust-resistant metal water container, equipped with handles and coated with baked porcelain enamel, a cover with built-in stainless steel agitator, operated with a solenoid type motor, and an inner steel, tin hot dipped, two-gallon milk container. A 1250 watt, 110-120 v., a.c., 60 cycle immersion-type heater is installed in the base.

When pasteurizing milk, the water tank is filled with nine quarts of water. When the water is heated to a temperature of 158° to 161° F., the thermostat setting, the light glows on the control panel. If warm water is used, less time will be required. The pail, containing from two quarts to two gallons of milk is then set in the water bath. This container is held by a strap hanger, supported on rubber gaskets. The cover assembly is next put in place and the motor-agitator plugged into the front panel outlet. The up and down action of the agitator causes the milk to circulate, thus insuring even temperature distribution. The time switch is set for one hour. If the milk is below 60° F., an extra 15 minutes should be allowed for heating the milk. The thermostat automatically turns the heater on and off to maintain the water and milk at the required temperature. When the bell rings, it indicates the end of the pasteurization process.

If a pressure water supply is available, cold water can be circulated around the milk container by means of a hose connection. An overflow hose is provided. Operation of the agitator for about 20 minutes will insure still faster cooling. Or, the milk container may be removed immediately after pasteurization and placed in a milk cooler for storage. Again, the agitator should be used to speed up the cooling.

The other batch pasteurizer manufactured by SAFGARD is model P-2000. It is marketed by General Electric Supply Corporation, Westinghouse Electric Supply Company and independent hardware and farm implement dealers.

This pasteurizer stands approximately 20 inches high and has an outside diameter of about 10 inches. It consists of an outer aluminum water container, equipped with handles, an aluminum cover with removable stainless steel agitator, operated with a 50 watt solenoid type motor and an inner aluminum, specially anodized two-gallon milk container. A 1250 watt, 110-120 v., a.c., 60 cycle immersion-type heater and a bellows activated micro-switch thermostat is installed in the base.

After pouring the milk into the pail and snapping on the Latex cover, the pail is placed in the outer container and locked into position. The drain hose is kinked and held with a steel clamp to maintain a definite water level. The outer container can be filled with the inlet hose with either hot or cold water from a faucet to just below the overflow slot. By using hot water and warm milk the time required for pasteurization can be reduced. The cover assembly is next put in place, the motor-agitator cord plugged into the front panel outlet, and the pasteurizer cord into a convenience outlet. The agitator insures even temperature distribution in the milk. The timer is turned to the "on" position. Being thermostatically controlled it will not operate until the milk has been heated to the pasteurizing

temperature. The thermostat automatically turns the heater on and off to maintain the water and milk at the required temperature. At the end of the holding period, the heating element is switched "off", a buzzer sounds and the timer pointer is turned to the "off" position to silence it.

If a pressure water supply is available, cold water can be circulated around the milk pail by means of the inlet hose which is inserted through the top. Remove the clamp from the drain hose thus providing an overflow for the incoming cold water. Operation of the agitator for about 20 minutes will insure still faster cooling. Or, the milk pail may be removed after pasteurization and placed in a milk cooler or cool water to reduce the temperature. A specially designed rack is placed on top of the pail to hold the cover so that the milk can be agitated and cooled more rapidly. After it is cooled, place the aluminum cap in the Latex cover opening and store it in a refrigerator.

The time required for pasteurization may range from 50 to 80 minutes and depends upon the starting temperature of the milk and water.

Another electric batch pasteurizer in which the milk container is heated directly is made by Waters Conley Company, Rochester, Minnesota and marketed by Sears, Roebuck and Company, Chicago, Illinois. It is approved by Underwriters' Laboratories, Inc.

The pasteurizer consists of a base having a 300 watt, 110-120 v., 50 or 60 cycle heating element with the thermostat placed in the bottom of a barrel which serves as a housing and flue to distribute the heat around a one-gallon covered milk bucket. It also has an outside cover for the purpose of keeping the lid of the milk bucket at pasteurization temperature. The height and diameter of the unit are about 14 and 10 inches respectively. The housing, bucket and outside cover are made of drawn aluminum. The outside surfaces are coated with baked lacquer. The lid of the milk bucket overlaps the rim so as to shed water when cooling the pasteurized milk. The thermostat is springmounted to insure good contact with the bottom of the bucket. A thermostatically controlled timer operates after the milk is heated to the pasteurization temperature. A buzzer sounds when the timer returns to the "off" position.

When pasteurizing milk, the timer knob is turned to the left as far as possible, the unit plugged into an outlet, and the operation is automatic. When the milk reaches the proper temperature, the heater is turned off and the timer starts operating and turning to the right. If the temperature of the milk drops below the pasteurization temperature, the thermostat turns on the heater and stops the timer until it is again up to temperature. At the end of the 30-minute pasteurization period, the current is cut off from the heater and a buzzer sounds until the timer is given a turn to the right.

With a full gallon of milk approximately one hour and 15 minutes are required to complete a pasteurization cycle. The time required may be more or less depending upon the amount and original temperature of the milk. Quantities less than a gallon may be pasteurized, although less than a quart may heat too rapidly.

It is claimed by the manufacturer that, by locating the heating unit near the edge of the milk container, convection currents are set up in the milk, thus heating it slowly and preventing scorching or localized overheating.

In-the-Bottle Pasteurizer

This pasteurizer was developed and is manufactured by H. E. Wright Company, 32 Cambridge Street, Charlestown 29, Massachusetts. This aluminum, kettle-shaped pasteurizer about 12 inches in diameter and 13 inches high has a capacity of six round or seven square quart bottles of milk. In each case an extra quart bottle filled with water is used for immersing a control thermostat which is fastened to the cover. The 1500 watt immersion-type heating element operates on 115 v., a.c., 60 cycles.

The unit is practically automatic in operation. When pasteurizing milk it is connected to the pressure water system by means of a hose. The capped bottles of milk are then placed in the tank. A little air space should be left in each bottle to allow for expansion of the milk. Fill the container with water to within one-half inch of the tops of the bottles. The depth is controlled by an overflow pipe which is adjustable for various heights of bottles. The cover is put on with the thermostat placed in the bottle of water. The thermostat cord is connected to the control panel on the side of the pasteurizer. The switch is put in the "on" position and press the button. A magnetic valve opens and water flows into the pasteurizer. After it is filled the switch is turned off and on again. This automatically cuts off the water flow and turns on the heater. When the milk has reached the pasteurization temperature of 154 degrees, the heat is cut off, cold water automatically enters the unit through the magnetic inlet valve, circulates around the bottles, and out the overflow. Cooling takes about 20 minutes and the flow of water is stopped by turning the switch to the "off" position. The milk is then ready for storage. About 85 minutes are required to heat and pasteurize the milk. The overall pasteurization time can be shortened by using warm water up to but not to exceed 120 degrees.

Milk Pasteurization Tests

A reliable and accurate test to determine whether milk and cream have been pasteurized adequately and known as the phosphatase test was developed and perfected in England and the United States. It is described as follows: "The test is based on the fact that all raw milk contains a phosphatase (phosphate-splitting) enzyme, which is destroyed by heating the milk at a temperature a few degrees higher than that required to destroy the most resistant of the pathogenic, or disease-producing, organisms that may occur in milk. When milk is pasteurized adequately the process destroys not only the pathogenic organisms but also the enzyme. Therefore, the absence of the enzyme in milk or in products made from milk, as determined by the Sanders and Sager test, indicates that the milk was pasteurized adequately. The presence of the enzyme indicates inadequate pasteurization."

According to the University of Connecticut and U. S. Department of Agriculture cooperating, the in-the-bottle pasteurizer operates with a margin of safety, insuring properly pasteurized milk as indicated by the phosphatase test, with the power cut off at 154 degrees or over.

The U. S. Public Health Service reported on tests made on former models of the three electric home pasteurizers discussed previously. Tests of the in-the-bottle pasteurizer showed negative phosphatase tests for both the milk and material on the swab of the upper inner surface of the milk bottles. Regarding the two batch pasteurizers, two solutions to the problem created by the absence of auxiliary methods for additional heating of the air above the milk level are suggested. They are: (1) Allow the heating water to completely surround the milk container. This will require tight-fitting non-porous covers that will not allow cooling water to enter the milk container. This suggestion was followed by the manufacturer of the pasteurizer that employs a water bath around the milk container by using a Latex cover. (2) Use higher temperatures which will insure that the milk vessel surface and the air above the milk level line will attain the proper temperature. The manufacturer of the pasteurizer which heats the milk container directly has added an outside cover in order to increase the temperature of the cover of the milk pail. Public Health Service states further that the two manufacturers of the batch pasteurizers have changed the construction of the tops of these units in order to raise the temperature with the hope of overcoming the presence of active phosphatase in the milk swabbed from the vessel surfaces above the milk surface line. When these are operated at temperatures that will insure proper heat treatment of the surface above the milk surface line they compare favorably with the double boiler method of home milk pasteurization which showed negative phosphatase tests.

The University of Nebraska also reported that the original model of the in-the-bottle pasteurizer satisfied the requirements. After the two batch type pasteurizers were modified to include a lid heater for heating the lid adjacent to the milk and the upper exposed portion of the pail these pasteurizers satisfied the requirements. Regarding the direct heated batch pasteurizer they stated that the redesigned model with the thermostat set as submitted by the manufacturer, when under test for a 36 minute holding period milk temperatures ranged from 148.5 degrees at the beginning of the period to 153 degrees at the end. Corresponding lid and upper pail temperatures ranged from 143.5 to 149 degrees. It is also their opinion that the redesigned water bath batch pasteurizer meets the necessary requirements.

The University of Illinois reports that pasteurization experiments conducted with the water bath batch pasteurizer showed satisfactory phosphatase tests. The in-the-bottle pasteurizer also gave satisfactory results in their laboratory.

It is recommended that cream be pasteurized for table use and also when churned into butter on the farm. Ice cream mix, when prepared in the farm home with raw milk and cream, should also be pasteurized. If these and milk made into cottage cheese are not pasteurized they can be disease carriers. The phosphatase test can be applied to all of these products as well as to milk.

It has been most gratifying to report the progress made in the research and development of electric home pasteurizers. As all milk-borne diseases can be controlled by proper pasteurization, it is important that every effort be made to develop and produce effective electrically heated and other equipment for home use, as demanded by the public, and thus prevent these diseases, deaths, and the economic loss suffered by the people of our country.

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